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# Tiered Implementation of the Bay TMDL

Kurt Stephenson and Denice Wardrop

Discussion with Principals' Staff Committee 20 December 2024

Based on "Tiered Implementation of the Chesapeake Bay TMDL: STAC Prospectus", Kurt Stephenson, Denice Wardrop, Leonard Shabman, Lee McDonnell, Gary Shenk, Kenny Rose, Mark Monaco, William Dennison, Jeremy Testa, Rich Batiuk, Zach Easton



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# The Problem

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The Scientific and Technical Advisory Committee's Comprehensive Evaluation of System Response (CESR) report highlighted several challenges that make achieving 100% of the Chesapeake Bay water quality standards much more difficult than expected. Specifically, meeting dissolved oxygen goals in the deep waters of the Bay's main channel is expected to take decades rather than years under current practices and programs.



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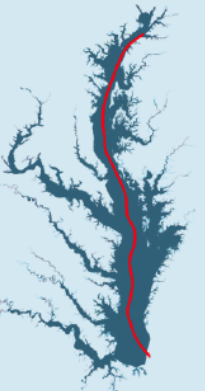
# Definition

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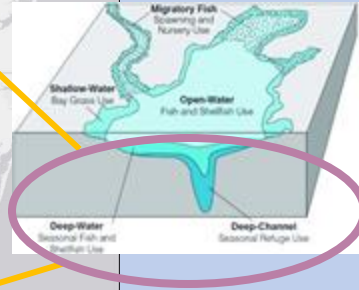
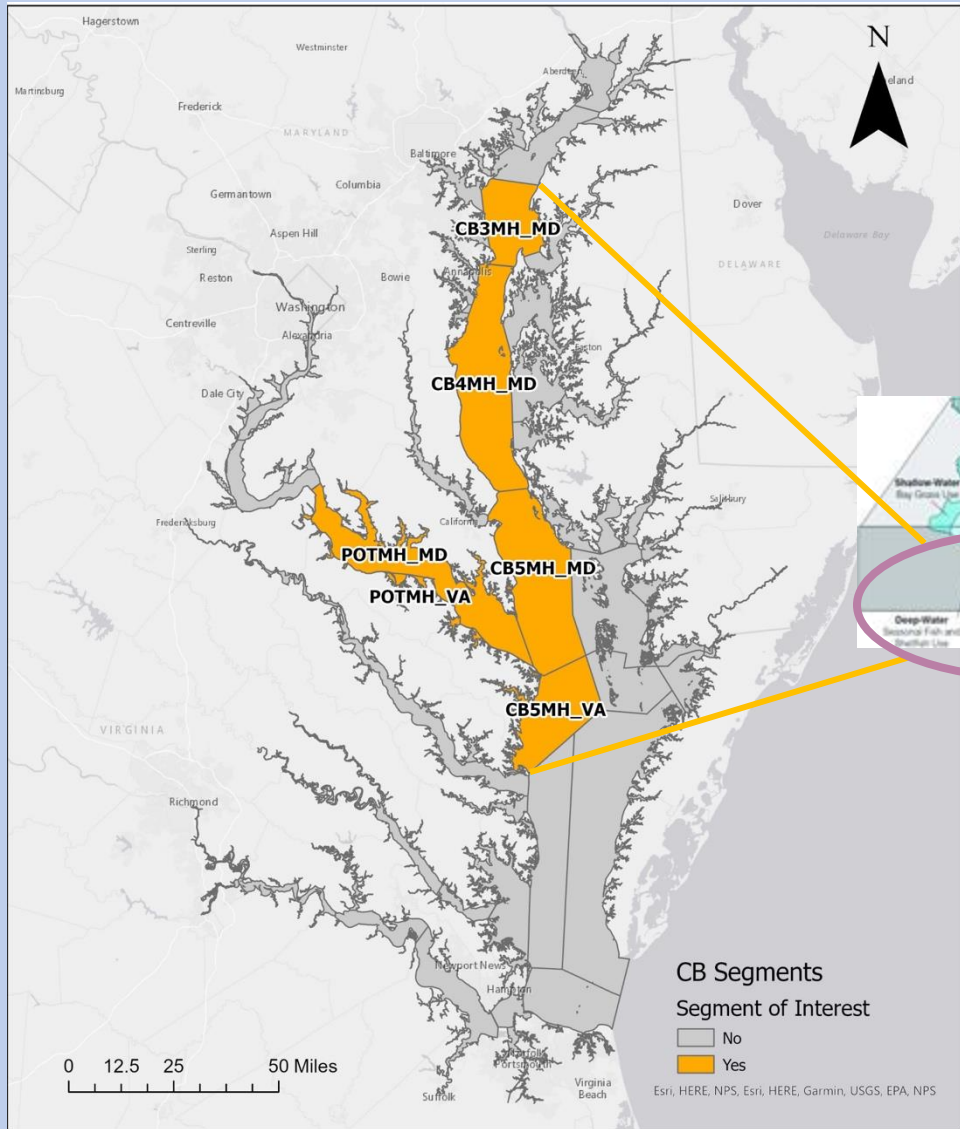
A tiered approach to TMDL implementation establishes staggered timelines, with interim goals that prioritize pollutant load reductions to segment/habitat regions of the Bay that can provide the greatest anticipated benefit to living resources



# Approaches to Implementing the Chesapeake Bay TMDL

	Tiered Approach	Conventional Approach
Areas prioritized to benefit from nutrient reductions	 <p>Areas where water quality (DO, water clarity) improvements can improve high priority living resource habitats</p>	 <p>Areas necessary for full attainment of water quality criteria (DO in deep water habitats in the main channel)</p>
Implementation objective	Water quality and other habitat factors	Water quality
Implementation horizon	10-15 yrs for interim goals	10-15 yrs for final TMDL target
Final load targets	Same	Same
Permittee obligations	Same	Same

# Existing Approach to TMDL Implementation



Nutrient load targets set to 100% WQS, focus on most challenging to achieve: DO criteria in deep water habitats in 4 segments (orange, left).

Nutrient effectiveness across watershed is set based on DO impact in these areas



# Tiering TMDL Implementation

## Chesapeake Bay Priority Living Resource Areas

Using GIS to Identify Habitat Hot Spots



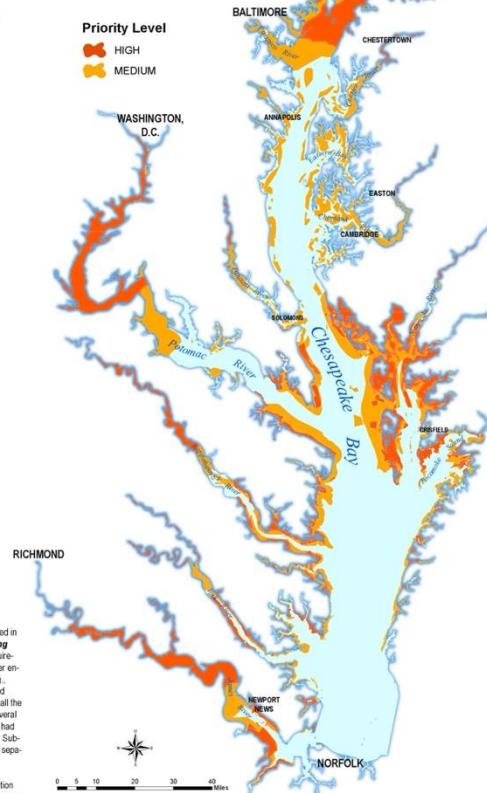
We direct the Chesapeake Bay Program to ... conduct an analysis and prepare a protocol ... to determine whether nutrient goals and reduction efforts can be further targeted to areas of persistent high loadings, especially where evidence indicates a linkage to critical living resources or human health concerns.  
Chesapeake Executive Council,  
Directive 97-1

**CREDITS:**  
Map and Analysis:  
John Wolf, National Park Service  
Chesapeake Bay Program Office  
610 Green Rd., Suite 100  
Annapolis, Maryland 21403  
Pat Heister  
Location Age, LLC  
Washington, DC  
Composite PLRA maps derived from data from the following sources:  
Funderburk, S.L., J.A. Mburika, S.J. Jordan, and D. Flay (eds.) 1992. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition.  
Salinity range data interpolated from 1985-1987 spring and summer Chesapeake Bay monitoring data.  
Potential open water habitat defined using modified Viers ground, Beaver ground, open water areas, and oyster structures.  
Tier II SAV areas (CBP and Virginia Institute for Marine Science)  
Aquatic Resources Graphics  
Symbols: courtesy of the Integration and Application Network  
(an office subproject), University of Maryland Center for Environmental Science and Chesapeake Bay Program.

### Water Column Species

- American Shad  
*Alosa sapidissima*
- Atlantic Menhaden  
*Brevoortia tyrannus*
- Bay Anchovy  
*Anchoa mitchilli*
- Striped Bass  
*Morone saxatilis*
- White Perch  
*Morone americana*
- Alewife  
*Alosa pseudoharengus*
- Hickory Shad  
*Alosa mediocristis*
- Yellow Perch  
*Perca flavescens*
- Blueback Herring  
*Alosa aestivalis*
- Chain Pickerel  
*Esox niger*
- Largemouth Bass  
*Micropterus salmoides*

**Priority Level**  
HIGH  
MEDIUM



### SAV

Submerged Aquatic Vegetation

### Bottom Species

- Atlantic Croaker  
*Micropogonias undulatus*
- Catfish
- Spot  
*Leiostomus xanthurus*
- Summer Flounder  
*Paralichthys dentatus*
- Blue Crab  
*Callinectes sapidus*
- Postlarval Blue Crab  
*Callinectes sapidus*
- Soft Shelled Clam  
*Mya arenaria*
- Hard Shelled Clam  
*Mercenaria mercenaria*
- Eastern Oyster  
*Crassostrea virginica*
- Atlantic Sturgeon  
*Acipenser oxyrinchus*
- Speckled Sea Trout  
*Cynoscion nebulosus*

### Methodology

The Chesapeake Bay Program's target species listed in *Habitat Requirements for Chesapeake Bay Living Resources, Second Edition* which had habitat requirements that could be directly affected by nutrient over-enrichment (e.g., dissolved oxygen) or sediments (e.g., light penetration) were arrayed by water column and bottom as their principal habitats. These included all the fish and shellfish species in that document, with several fish species and related layers added for which we had new potential habitat information. Priority areas for Submerged Aquatic Vegetation (SAV) were considered separately.

In the case of species with potential habitat distribution maps for multiple life stages, composite maps were produced by combining the individual GIS layers for each life stage. For species with separate spring and summer potential habitat distributions, a composite map was produced reflecting the combined extent of seasonal-based habitats.

Keeping the water column and bottom species separate at the beginning, the composite maps for each of the 11 species were overlaid. Each species' potential habitat was weighted equally as there was no straightforward justification for applying a weighting scheme.

With the water column and bottom habitat overlay maps still separate, team members looked for regions with clusters of common total numbers of target species habitats overlapping each other that reflected natural "break points" between otherwise contiguous geographical concentrations. The team assigned specific range designations (and, therefore, different colors) for the respective polygons that fell within the following ranges: areas with 9-11 species were assigned as high priority for both water column and bottom overlay maps with area containing 7-8 species and 8 species, respectively, design-

ated as medium priority in the water column and bottom overlay maps. Areas with less than these total number species overlaid dropped out.

Then the water column and bottom habitat maps were themselves overlaid to produce the draft **Priority Living Resources Areas** map. The high priority areas for both water column and bottom were combined so that an area was shaded as high priority if it appeared in either layer, the two medium priority layers were combined the same

way. The team then visually examined the resultant map and drew polygons around the 14 areas—the designated draft **Priority Living Resource Areas**—that had the most extensive and contiguous high priority shading. The medium priority areas were included on the map because they were also important living resource habitats.

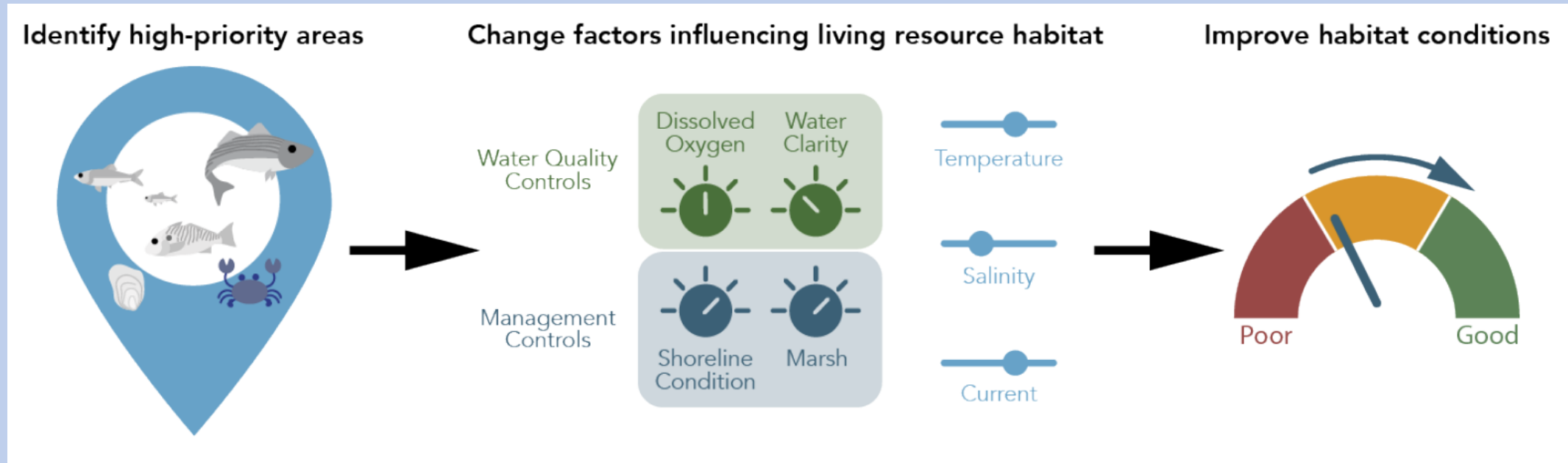
Priority areas for Submerged Aquatic Vegetation (SAV) were determined by the SAV Workgroup using the VIMS SAV aerial survey data base, examining changes in SAV area over 1992-1997, and SAV status as a percentage of Tier II area in 1997 by the 78 CBP segments. Changes over 1992-1997 were used because many SAV trends changed direction at about that time, and the more recent changes were of the greatest interest. Priority SAV areas were those segments that lost over 60 hectares of SAV from 1992 to 1997, and segments that had no SAV mapped in 1997. These layers were not combined with the fish and shellfish layers shown here because they were based on different data and used different spatial scales. They were visually compared to the Priority Living Resource Areas (PLRA) defined based on the fish and shellfish layers, and all of the SAV priority areas were also identified as PLRAs, with the exception of four small Maryland tributaries that lacked SAV in 1997 but were not identified as PLRAs (the Back, Rhode, West, and Pocomoke rivers).

Establish interim nutrient and sediment targets based on places where water quality is a factor for living resource potential (red & orange, left), while acknowledging:

- interdependence across areas (including progress in main channel);
- importance of local, non-WQ living resource factors/stressors.



# Select where changes in water quality can potentially improve habitats



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# Summary:

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1. Prioritize water quality improvements based on impact to living resources
2. Achievable, more impactful pollutant reductions
3. Science and technical capacity to implement but will require time and effort

